SECTION A: WATER USE

Appendix

Introduction to Onsite Wastewater Treatment Systems

The purpose of an onsite wastewater treatment system is to adequately treat wastewater before it is discharged to the environment. Adequate treatment means removing pathogens and filtering excess nutrients from wastewater. The pathogens to be treated are viruses and fecal coliform bacteria, whereas excess nutrients to be filtered include nitrogen and phosphorus. Onsite systems are more effective at filtering phosphorus than nitrogen, however, and they may not reduce nitrogen levels below drinking water standards.

Basic Components of Onsite Systems:
An onsite system typically consists of two components for wastewater treatment: 1) a septic tank (primary treatment), which collects all wastewater and retains the solids; and 2) a secondary treatment medium, to provide wastewater treatment to remove contaminants before the wastewater is returned to the environment.

Secondary treatment media serve two separate functions: treatment and dispersal. Treatment means treating wastewater to remove pathogens and other contaminants, whereas dispersal refers to the manner in which treated wastewater is discharged. Some types of systems, such as soil absorption trenches, provide soil-based treatment and dispersal, since both treatment and dispersal take place in the soil. Other types of systems, such sand filters and mounds, provide nonsoil-based treatment, which means they use some other medium besides soil to treat wastewater. Mounds rely on soil dispersal, however, whereas sand filters rely on surface dispersal.

Basic Types of Onsite Systems:
A "conventional" onsite system refers to a septic tank followed by soil absorption trenches, which are trenches dug laterally into the soil. The various media for distributing effluent through soil absorption trenches include rock, chambers, and gravelless pipe.

An "alternative" onsite system refers to a septic tank followed by some form of secondary treatment *other than* soil absorption trenches. Some alternative systems, such as mound systems and at-grade systems, provide secondary wastewater treatment before dispersing treated wastewater <u>to the soil</u>. Other types of alternative systems provide secondary wastewater treatment, then discharge treated wastewater <u>to the surface</u>. Surface-discharging systems include sand filters, constructed wetlands, and mechanical aerobic systems. Mechanical aerobic systems rely upon a motorized aeration chamber to treat wastewater.

"Innovative" systems refer to newer systems that do not yet have a prescriptive design in Chapter 69. They may be either subsurface-discharging or surface-discharging systems, and they may be soil-based or nonsoil-based treatment systems. Current examples of innovative systems are peat filters and fixed media filters.

SOURCES OF WASTEWATER

Sewage means waste produced by toilets, bathing, laundry, cooking, washing dishes, or floor drains associated with these sources. Sewage does not include “clean” water such as swimming pool water, roof drainage, water softener recharge water, or water used to irrigate gardens. Chapter 69 does allow water softener recharge water to be discharged into an onsite wastewater system, while other “clean” water may not.

The amount of water discharged to an onsite sewage treatment system is one of the factors used in sizing that system. The other factor is determined by the texture, structure, and percolation rate of the soil.

Water use varies widely among individuals, depending on such factors as background, age and economic status. For example, an individual who was raised in a household without running water will probably be very conservative in water use even when running water is available. Teenagers are typically high water users. The use of hot tubs or water-circulating devices for therapeutic services greatly increases water use. In general water use goes up as income level increases.

A number of studies have been made throughout the country on water use habits and rates. In studies made during the 1970s, average water use per person, nationwide, was about 45 gallons per day. A 1998 study found a national water-use rate of about 80 gallons per person per day, and 69 gallons per person per day in Minnesota. A “true” average water use rate may never be known.

The estimates of flow used in Iowa to size sewage treatment systems allow for a safety factor so that systems will function properly even when serving a residence or other establishment with higher than average rates of water use. General practice is to use a value of 75 gallons per person per day as the water use rate.

Estimating Sewage Flows

Dwellings

A **dwelling** is any building or place used or intended to be used by human occupancy as a single-family or two-family residence, with no more than nine bedrooms, and producing sewage. Dwelling does not include a single-family or multifamily residence that serves both as a domicile and a place of business, if the business increases the volume of sewage above what is normal for a dwelling, or if the liquid waste generated no longer qualifies as sewage.

The estimated sewage flows presented in Figure A-1 are based on the number of bedrooms in a residence. While the *individuals* who occupy a residence use the water, the number of bedrooms is considered a good index of the potential water use.

Number of Bedrooms	Gallons per Day
2	300
3	450
4	600
5	750
6	900
7	1050
8	1200

For a residence, the estimated water use is equal to 150 gallons per day (gpd) per bedroom. This assumes an occupancy of two people per bedroom, each using 75 gpd. This is a high estimate for many residences, although it may be low for large and high-value residences.

Other Establishments

"Other establishment" is any public or private structure, other than a dwelling, that generates sewage and discharges it to an onsite system. Other establishments may have large flows and/or high-strength waste, which Chapter 69 does not address.

Cluster Systems

Any cluster system under single ownership is designed as the sum of residences served by the system. Tank size is the sum of the total tanks required for the residences in the system. Individual flows from houses are estimated as separate establishments or homes. Apartments should be the considered as if each unit were a single home**. If the design flow is more than 1500 gpd or the cluster serves more than 10 bedrooms, a public wastewater permit is required and Chapter 69 may not apply for the design of the system. Contact an engineer and the IDNR.**

Domestic sewage is generated by a dwelling; a toilet facility at an establishment open to the public; rental units, such as motels and resort cabins; shower and toilet facilities for schools or campgrounds; or any establishment that only generates bathroom, kitchen or laundry wastewater.

Non-domestic waste is generated by other sources, such as car washes and other light industrial establishments.

Figure A-2 presents flow estimates for many types of facilities that generate sewage.

Even though size of residence is used to estimate sewage flow, a sewage treatment system is designed for a certain number of gallons per day, not for a certain size residence. For example, if a system is sized for 450 gallons a day (three-bedroom home), and the home actually discharges 600 or 700 gallons per day, hydraulic failure is likely to occur. Each soil unit has a finite waste treatment capacity, which, if consistently exceeded, will lead to hydraulic overload and failure of that system.

Measuring Flow

While it is often necessary to use the values in Figure A-2 to estimate sewage flows, more accurate data should be obtained if possible. For example, if a small restaurant is to be located beyond the reach of municipal sewer, then data should be obtained from comparable facilities.

Septic systems are becoming more expensive, both to install and to repair, so one goal is to design them to treat the actual wastewater flow, rather than an estimate that may be high or low. Another goal is to get optimum use over the longest possible time from existing systems. In order to achieve these goals it's helpful to know actual flow rates, which the water meter provides. To keep track of the amount of water entering the septic system, include a water meter in the design of the system, or add one to an existing system, for example. Some eating and drinking establishments use icemakers that use large amounts of tap water to cool the ice. This water is often discharged into the sewer system. This wastewater should not be added into the septic system.

Water meters come in many different shapes and sizes. Most water meters are designed to deal with clean water, which means that they may not function properly if they are used to measure the flow of sewage. For example, many water meters have small paddles or wheels that move around to measure flow. These moving parts can be easily plugged by solids in sewage. One way to avoid this problem is to measure the flow of clean water before it is used in the house.

Clean-Water Meter

These meters should measure the water used inside the house, but not the water used outside for watering lawns and gardens, filling swimming pools, or washing cars, since this water does not enter the septic system. If it's difficult to install a water meter so that it doesn't include the water to be used outdoors, try to estimate outside use, or use only data from December to March, when there is typically no outdoor use of water.

	gallons per day per unit***	
	Avg*	**Max****
Dwelling Units		
hotel or luxury motel* **		
each guest	50	60
+ for each employee	11	13
or per square foot	0.26	0.3
motel******		
each guest	35	40
+ for each employee	11	13
or per square foot	0.22	0.46
rooming house******		
each resident	40	50
+ for each nonresident meal	2.5	4.0
daycare		
each child	25	25
Commercial/Industrial		
retail stores		
per sq. foot of sales area	0.1	0.15
or each customer	2.5	5
+ for each employee	11	15
or each toilet room	530	630
offices		
+ for each employee	15	18
or per square foot	0.1	0.25
medical office		
per square foot	0.6	1.6
industrial building		
+ for each employee	15	20
(Does not include process water or cafeteria)		
construction camp		
+ for each employee	15	20
visitor center		
each visitor	5	20
laundromat		
each machine	580	690
or each load	50	50
or per square foot	2.2	2.9
barber shop		
per chair	55	80
beauty shop		
per station	270	300
car wash		
per inside square foot	5	10
(Does not include car wash water)		

	gallons per day per unit***	
	Avg*	**Max****
Eating and Drinking Establishments		
restaurant* **		
per meal	2.5	4.0
(Does not include bar or lounge)		
or each seat	24	40
+ for each employee	11	13
dining hall* **		
per meal	2.5	4.0
coffee shop* **		
each customer	2.0	2.5
+ for each employee	11	13
cafeteria* **		
each customer	2	2.5
+ for each employee	11	13
drive-in* **		
per car stall	110	145
bar or lounge* **		
each customer	2	5.5
+ for each employee	11	13
or per seat	32	40
Institutional		
hospitals		
each medical bed	175	260
+ for each employee	10	16
mental institution******		
each bed	105	175
+ for each employee	10	16
prison or jail******		
each inmate	120	160
+ for each employee	10	16
nursing home******		
each resident	93	145
+ for each employee	10	16
Transportation		
airport, bus station or rail depot		
per passenger	2.5	4
or per square foot	3.33	6.5
or per public restroom	500	630
auto service station		
each vehicle served	11	13
+ for each employee	13	16
or per inside sq. foot	0.25	0.6
or per public restroom	500	630

	gallons per day per unit***	
	Avg*	Max**
Recreational		
campground with hookups***		
per person	32	40
or per site	100	100
with central bath per site	50	75
add for dump station site with hookup	13	16
day camp (no meals)		
per person	13	16
YMCA/YWCA		
per member	33	33
country club		
per member	22	22
(no meals)		
per member	105	130
(meals and showers)		
per member	75	100
(in residence)		
housekeeping cabin		
per person	42	50
lodge		
per person	53	74
parks or swimming pools		
per guest	10	13
picnic parks with toilet only		
per guest	5	10
movie theater		
per guest	2.5	4
drive-in theater		
per space	3	5
skating rink or dance hall		
per customer	7	10
bowling lanes		
per lane	133	250

See SECTION C for tank sizing, page 5

	gallons per day per unit***	
	Avg*	Max**
Schools and Churches		
day school****		
per student	10	17
(no gym, cafeteria or showers)		
per student***	16	20
(cafeteria only)		
per student***	20	30
(cafeteria, gym and showers)		
boarding school*,******		
per student	75	115
church		
per member	0.14	0.86
+ for each kitchen meal	1	1
+ per Sunday school student	0.14	0.86

*Average (Secondary Treatment Design Flow) ie laterals
**Maximum (Septic Tank Design Flow)
***High waste strength systems
****Excessive solids, particularly lint

* Figures in the "average" column designate an average daily flow and may be used for sizing the secondary treatment **unit**.

** Values in the "maximum" column are the average peak flow rates and should be used for **sizing the septic tank or tanks** so that adequate volume is available on peak flow days.

Remember, these figures are only estimates of average flow rates and each facility is different.

References:

Onsite Wastewater Treatment and Disposal Systems Design Manual, U.S. EPA, October 1980.

Forecasting Municipal Water Requirements, Vols. I and II, U.S. Department of Commerce, September 1969.

Tchobanoglous, G., and F. Burton. Wastewater Engineering: Treatment, Disposal, and Reuse, third edition, Irwin/McGraw-Hill, 1991.

Water meters measure flow in either gallons, or cubic feet. Before doing any calculations using data from the meter, check to be sure of the units of measurement. Designs for septic systems typically use gallons per day. If it measures cubic feet per second, multiply by 7.48 to convert to gallons per day.

The water meter should be installed by a plumber to make sure it's put in properly. Although it is installed directly into the water system, it won't affect water pressure.

Another type of clean water meter often found in houses is an on-demand water softener. These water softeners measure flow and recycle at certain set flow amounts. This system may also be used to calculate water flow. These calculations are not as straightforward as simply reading a meter and multiplying by a factor, but this is a valid method of measuring clean water flow.

Wastewater Measurements

Instead of measuring water use in the house, you can also measure wastewater going out to the septic system. To do this, you could try to use a water meter, but the water entering the meter would need to be free of solids.

The use of a pump as a wastewater meter is more common. All pumps run at a certain rate, so water flow can be calculated and calibrated from the pump system. This calibration is very straightforward, in that you measure the level in the tank, run the pump for a certain amount of time, measure the amount of water that has left, divide that by the amount of time that the pump was running, and come up with a pumping rate in gallons per minute. Using this rate, you can calculate how much water has been pumped, based on how long the pump has been running.

Example: A tank contains 100 gallons per foot of water depth, and the depth of wastewater is three feet. You run a pump for two minutes, and now the wastewater is two feet deep. 100 gallons have been pumped in 2 minutes, so the rate was 50 gallons per minute. Now find out how many minutes the pump runs in the course of a day. If the same pump ran for ten minutes, then during that day it pumped 10 times 50 or 500 gallons. This is a quick way to use a pump and a clock to calculate how much water is being used.

Once you know the pump's rate, check it regularly. It may slow down to the point where it is not evenly distributing wastewater to the soil treatment system, the line is plugged, there is an air lock, the impeller is worn, or it is failing for some other reason. By checking periodically, you know there is a problem it stops working.

Another way to use a pump as a measurement device is to use an event counter. An **event counter** is a meter that records every time the pump turns on. You know from the septic system design how many gallons are to be pumped each time the pump turns on, so by counting the number of times it turns on during a day you can measure the flow of wastewater going out to the system. This is not as accurate as a running time clock because the floats that turn the pump on have some variability. That is, the pump may turn on at six inches the first time and then 6-l/2 inches the second time. That can be a 15 to 20 gallon discrepancy each dose. If the event counter is turning five times a day, at a 20-gallon per time discrepancy, your calculations could be off by as much as 100 gallons of water that day.

However it is measured, flow is critical data that will allow the best design and operation of the septic system. Estimated flow is a great design tool. It allows for a safety factor and peace of mind. Measured flow is used both to design systems and to verify performance. By using both flow figures appropriately, you give the system the best chance of good long-term performance.

Calculating Design Flows

It is recommended that **average design flow be used** to calculate the secondary treatment system sizing and **maximum design flow used** to calculate septic tank sizing for "other establishments." Water meter data can be used to calculate average design flow and maximum design flow.

Measured maximum design flow is the anticipated peak daily flow. **Measured average design flow** is determined by averaging the measured daily flows for a consecutive seven-day period in which the establishment is at maximum capacity or use.

A method to calculate both the measured maximum design flow and the measured average design flow, requires two sets of data:

1) daily flow data and
2) capacity of the establishment for each day.

A minimum of two months of data is necessary, and one full year of data is recommended (the more data you have, the greater the confidence you will have in your design assumptions).

Daily flow should be in gallons per day (gpd). Some water meters give cumulative readings (so that one day the meter may measure 400 gallons, the next day 850 gallons, and the next day 1,200 gallons). If this is the case, make sure to convert the gallons into a per day unit. In this example, 400 gallons are discharged on day 1; 850 - 450 = 400 gallons for day 2; and 1200 - 850 = 350 gallons for day 3. Make sure you are using the correct units when you use the information to design a system.

Components of Wastewater

The components of wastewater may be divided into four categories:

- Pathogens
- Nutrients
- Biochemical Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Other chemicals

Figure A-4 shows typical concentrations of these components in raw waste, septic tank effluent, and soil.

Figure A-4: Treatment Performance of Soil				
parameter	**raw waste**	**septic tank effluent**	**one foot below trench bottom**	**three feet below trench bottom**
BOD_5 (mg/L)	270 - 400	140 - 220	0	0
TSS (mg/L)	300 - 400	45 - 65	0	0
fecal coliform (MPN/100ml)	1,000,000 – 100,000,000	100,000 – 100,000,000	0 – 100	0
viruses (PFU/ml)	unknown	1,000 – 1,000,000,000	0 – 1,000	0
nitrogen (mg/L)				
total	100 – 150	50 – 60	----	----
NH_4	60 – 120	30 – 60	*B – 60	*B
NO_3	<1	<1	*B – 40	*B – 40
total phosphorus (mg/L)	10 – 40	10 –30	*B – 10	*B –1
*B = background level of naturally occurring parameter in soil				

Pathogens

The most critical component, in terms of what must be removed from wastewater, is pathogens. Pathogens are organisms that cause disease, including viruses, protozoan, and bacteria. Pathogens may be found in wastewater from anywhere in the house. Any human contact with water results in the potential to add pathogens to the environment. The presence of pathogens in wastewater makes its treatment a public health issue, because of the risk of spreading disease.

Fecal coliform bacteria are pathogens used as an indicator of the presence of any pathogens in wastewater. These bacteria are residents of human intestinal tracts. Fecal coliform bacteria are fairly easy to test for, and their presence is an indication that other pathogens, which are more difficult to isolate and identify, may also be present. An average value for fecal coliform bacteria in septic tank effluent is 1,000,000 organisms per 100 milliliters.

Disinfection of the wastewater is discussed in Section G.

Nutrients

Two nutrients are of primary concern in wastewater treatment: phosphorus and nitrogen. These nutrients have different chemical characteristics: phosphorus tends to bind to soil particles, while nitrogen is more mobile in the soil.

Phosphorus is a nutrient essential to the growth of plants and microorganisms. A typical value for phosphorus in septic tank effluent is 7 milligrams per liter.

The concern with phosphorus is its impact on surface waters in Iowa. Most surface water in Iowa is phosphorus-limited, meaning that any additional phosphorus will result in the growth of more plant life. Growth of algae and weeds dramatically affects lake ecosystems, and lowers their aesthetic appeal and recreational value.

Nitrogen is also an essential nutrient for the growth of plants and microorganisms. Wastewater usually contains fairly high levels of nitrogen, which appear in four different forms: organic nitrogen, ammonia, nitrate, and nitrite. As nitrogen moves through the treatment system, it changes from ammonia to nitrate. While it is possible for nitrate to change into nitrogen gas in some systems, standard trench and bed systems do not make this change, so the nitrate moves into groundwater. A typical level of nitrogen in septic tank effluent is 40 milligrams per liter.

In drinking water, which is often from groundwater, high levels of nitrogen can be toxic to infants, causing methemoglobinemia, “blue baby syndrome.” Ammonia in surface waters can be toxic to fish.

Biochemical Oxygen Demand, Dissolved Oxygen, and Total Suspended Solids

BOD is the most widely used parameter applied to the evaluation of the strength of wastewater. BOD is a measure of the dissolved oxygen required by microorganisms to oxidate or decompose the organic matter, and oxidize inorganic material such as ammonia in the wastewater . A typical BOD value for a standard system is 220 milligrams per liter. Another term often used is CBOD this is the Carbonaceous Biochemical Oxygen Demand. This is the amount of oxygen consumed, in the test period, to decompose the organic matter. Typically the test period is run for 5 days and is referred to as 5-day BOD or CBOD.

When the dissolved oxygen (DO) contained in septic tank effluent is measured, it’s usually very low; typically one milligram per liter. While DO in groundwater can be as high as 12 milligrams per liter, the microorganisms in the septic tank normally use up any available oxygen to break down organic matter. If the DO in the septic tank water is above 2 mg/l this is a sign that ground water is probably leaking into the tank. The DO in most mechanical aerobic systems is in the 8-10 mg/l range.

Total Suspended Solids (TSS) are a measure of the solids or particles that remain in the wastewater after settling has occurred in the septic tank. A typical TSS value for effluent for septic tank wastewater is 65 mg/l.

Biochemical Oxygen Demand and Total Suspended Solids together measure the strength of the wastewater. They can serve as an indicator of system performance.

For information on sampling wastewater for these components, see Appendix A-3: Monitoring Wastewater Characteristics.

Other Chemicals and Hazardous Waste

Hazardous waste should not be added to a treatment system. Nonhazardous wastes, including detergents, shampoos, antibacterial soap, and salt from water softeners, have not been shown to have detrimental effects under normal household loading. Excessive loading of any of these chemicals, however, can cause problems with the treatment process.

Of particular concern are continuous toilet cleaners and formaldehyde. Because the toilet flow represents nearly 40 percent of total wastewater, continuous use of a sanitizer can cause problems and should be avoided. Formaldehyde, typically used in chemical toilets, also causes major system problems and should be avoided.

If a residence or any other facility plans to dispose of hazardous waste into an onsite system, problems can occur. These systems would be considered **Class V- injection wells,** and are subject to Federal regulations. Photography businesses, auto repair shop, or taxidermists, for example, may generate hazardous waste. A facility that disposes of such waste should not discharge to a subsurface treatment system.

In the case of filling station wastes, oil, grease and floor washing wastes from the service bay should be discharged to a holding tank separate from the sewage system treating the toilet wastes. Any liquid waste containing petroleum products **should not** be discharged into a subsurface treatment system. A car wash area may also contain for hazardous waste, and shall also not discharge to a subsurface treatment system.

Appendix A-1: Equivalents, Equations, and Abbreviations

Equivalents and Equations:

pi (π) = 3.14

one cubic foot of water = 7.5 gallons

231 cubic inches of water = one gallon

27 cubic feet = one cubic yard

area of a rectangle or square = length x width

area of a circle = π x radius^2

volume of a box or cube = length x width x depth

volume of a cylinder = π x diameter^2 $\div$ 4 x depth

flow = volume over time (gallons per minute)

loading rate = gallons applied per day $\div$ area applied

pump capacity = gallons pumped during a cycle $\div$ run time

one foot of head = 0.43 pounds per square inch (psi)

one psi = 2.31 feet of head

one acre = 43,560 ft^2

Common Abbreviations

a = area

cfs = cubic feet per second

d = diameter

d = diameter

ft^2 or sqft = square feet

cuft = cubic feet

gal = gallons

gpm = gallons per minute

gpd = gallons per day

gpd/sqft = gallons per day per square foot

hr = hour

m = minute

in = inch

L = liter

mg = milligram

ml = milliliter

ppm = parts per million

psi = pounds per square inch

Q = flow (quantity)

π = pi (ratio of diameter of a circle to its circumference)

$>$ = greater than

$\geq$ = equal to or greater than

$<$ = less than

$\leq$ = equal to or less than

Appendix A-2: Homeowner's Responsibilities for Use of an Onsite Sewage Treatment System

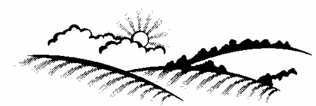
The following 2 documents are reproduced from the National Small Flows Clearing House.

They Have a good web site for information and can provide technical assistance.

http://www.nesc.wvu.edu/nsfc/nsfc_index.htm

- Check with your local regulatory agency if you have a garbage disposal unit to make sure that your septic system can accommodate this additional waste.
- Check with your local regulatory agency before allowing water softener backwash to enter your septic tank.
- Your septic system is not a trash can. Do not put grease, disposable diapers, sanitary napkins, tampons, condoms, paper towels, plastics, cat litter, latex paint, pesticides, or other hazardous chemicals into your system.
- Keep records of repairs, pumpings, inspections, permits issued, and other system maintenance activities.
- Learn the location of your septic system. Keep a sketch of it handy with your maintenance record for service visits.
- Have your septic system inspected every 1–2 years and pumped periodically (usually every 3–5 years) by a licensed inspector/contractor.
- Plant only grass over and near your septic system. Roots from nearby trees or shrubs may clog and damage the absorption field.
- Do not drive or park over any part of your septic system. This can compact the soil and crush your system.

In summary, understanding how your septic system works and adhering to these few simple rules will ensure that your septic system is a safe and economical method for treating and disposing of your wastewater onsite.



For more information regarding the care of your septic system, contact your local health department.

More information about septic systems is available from the National Small Flows Clearinghouse (NSFC) through other brochures in this series:

Groundwater protection and your septic system, Item **#WWBRPE21**

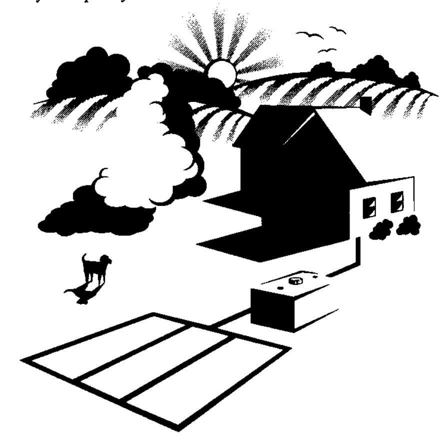
The care and feeding of your septic system, Item **#WWBRPE18**

For more information about this or other NSFC products, please contact us by writing to:
National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064
or phone:
(800) 624-8301, (304) 293-4191
or fax: (304) 293-3161
www.nsfc.wvu.edu

Helping America's small communities meet their wastewater needs

So . . . now you own a septic system

One in a series of three brochures designed to aid you in caring for your septic system.



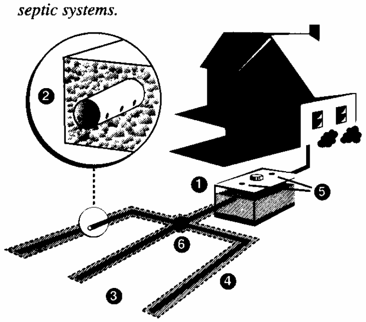
Helping America's small communities meet their wastewater needs

So . . . now you own a septic system

More than 25 million homes, encompassing almost 25 percent of the U.S. population, dispose of domestic wastewater through onsite (unsewered) systems. According to the American Housing Survey for the United States, in 1993 1.5 (million) out of every 4 (million) new owner-occupied home starts relied upon a form of onsite sewage disposal.

One of the major differences between owning an unsewered versus a sewered home is that unsewered wastewater treatment and disposal systems must be maintained by the homeowner. Treatment and disposal of wastewater should be one of the primary concerns of any homeowner in an unsewered area.

The most common way to treat and dispose of wastewater in rural homes is through the use of an onsite disposal system. The majority of onsite disposal systems in the United States are septic systems.



1. septic tank
2. 4" perforated pipe
3. absorption field
4. crushed rock or gravel lined trench
5. inspection ports
6. distribution box

Typical Septic System Fig. 1

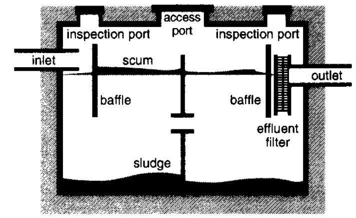
HOW IT WORKS

A typical septic system contains two major components: a septic tank and the absorption field (see Figure 1). Often, a distribution box is included as part of the system to separate the septic tank effluent evenly into a network of distribution lines that make up the absorption field. The septic tank is usually made of concrete, fiberglass, or plastic, is typically buried and should be watertight. All septic tanks have baffles (or tees) at the inlet and outlet to insure proper flow patterns (see Figure 2). Most septic tanks are single compartment; however, a number of states require two-compartment tanks or two single compartment tanks in series.

While typically designed to hold a minimum of 750–1000 gallons of sewage, the size of the tank may vary depending upon the number of bedrooms in the home and state and local regulatory requirements. The primary purpose of the septic tank is to separate the solids from the liquids and to promote partial breakdown of contaminants by microorganisms naturally present in the wastewater. The solids, known as sludge, collect on the bottom of the tank, while the scum floats on the top of the liquid. The sludge and scum remain in the tank and should be pumped out periodically (see Figure 2).

Solids that are allowed to pass from the septic tank may clog the absorption field. Keeping solids out of the absorption field not only prevents clogging, but also reduces potentially expensive repair or replacement costs and helps ensure the ability of the soil to effectively treat the septic tank effluent. Therefore, an additional safeguard in keeping solids out of the absorption field is the use of effluent filters on the outlet of the septic tank (see Figure 2).

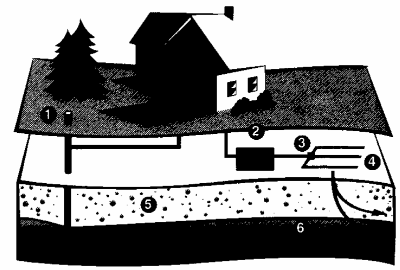
The wastewater (effluent) coming out of the septic tank may contain many potentially disease-causing microorganisms and pollutants (i.e., nitrates, phosphates, chlorides). The effluent is passed on to the absorption field through a connecting pipe or distribution box. The absorption field is also known as the soil drainfield, the disposal field, or the leachfield. The absorption field contains a series of underground perforated pipes, as indicated in Figure 1, that are



Cross-section of a two-compartment septic tank Fig. 2

sometimes connected in a closed loop system, as illustrated on the front cover, or some other proprietary distribution system

The effluent is distributed through the perforated pipes, exits through the holes in the pipes, and trickles through the rock or gravel where it is stored until absorbed by the soil. The absorption field, which is located in the unsaturated zone of the soil, treats the wastewater through physical, chemical, and biological processes. The soil also acts as a natural buffer to filter out many of the harmful bacteria, viruses, and excessive nutrients, effectively treating the wastewater as it passes through the unsaturated zone before it reaches the groundwater (see Figure 3).



1. drinking water well
2. septic tank
3. distribution box
4. absorption field
5. soil absorption (unsaturated zone)
6. groundwater (saturated zone)

Wastewater treatment and disposal in soil Fig. 3

Wastewater contains nutrients, such as nitrates and phosphates, that in excessive amounts may pollute nearby waterways and groundwater supplies. Excessive nutrients in drinking water supplies can be harmful to human health and can degrade lakes and streams by enhancing weed growth and algal blooms. However, the soil can retain many of these nutrients, which are eventually taken up by nearby vegetation.

What to Put In, What to Keep Out

- Direct all wastewater from your home into the septic tank. This includes all sink, bath, shower, toilet, washing machine and dishwasher wastewaters. Any of these waters can contain disease-causing microorganisms or environmental pollutants.

- Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the absorption field. Flooding of the absorption field with excessive water will keep the soil from naturally cleansing the wastewater, which can lead to groundwater and/or nearby surface water pollution.

- Conserve water to avoid overloading the septic system. Be sure to repair any leaky faucets or toilets. Use low-flow fixtures.

- Do not use caustic drain openers for a clogged drain. Instead, use boiling water or a drain snake to open clogs.

- Do not use septic tank additives, commercial septic tank cleansers, yeast, sugar, etc. These products are not necessary and some may be harmful to your system.

- Use commercial bathroom cleaners and laundry detergents in moderation. Many people prefer to clean their toilets, sinks, showers, and tubs with a mild detergent or baking soda.

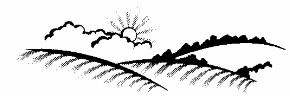
continued . . .

Septic System Health Tips

What you put into your septic system will have a direct effect on whether or not you have a healthy, long-lasting and trouble-free system. Your septic system is not a dispose-all.

- Conserve water to avoid overloading the septic system. Be sure to repair any leaky faucets or toilets. Use low-flow fixtures.
- Do not use caustic drain openers for a clogged drain. Instead, use boiling water or a drain snake to open clogs.
- Do not use septic tank additives, commercial septic tank cleansers, yeast, sugar, etc. These products are not necessary and some may be harmful to your system.
- Use commercial bathroom cleaners and laundry detergents in moderation. Many people prefer to clean their toilets, sinks, showers, and tubs with a mild detergent or baking soda.
- Check with your local regulatory agency if you have a garbage disposal to make sure that your septic system can accommodate this additional waste.
- Check with your local regulatory agency before allowing water softener backwash to enter your septic tank.
- Your septic system is not a trash can. Do not put disposable diapers, sanitary napkins, tampons, condoms, paper towels, facial tissues, plastics, cat litter, or cigarettes into your septic system. These items quickly fill your septic tank with solids, decrease the efficiency, and will require that you pump out the septic tank more frequently. They may also clog the sewer line to the septic system causing wastewater to back up into your home.
- Avoid dumping grease or fats down your kitchen drain. They solidify and the accumulation may contribute to blockages in your system.
- Keep latex paint, varnishes, thinners, waste oil, photographic solutions, pesticides, or other hazardous chemicals out of your system. Even in small amounts, these items can destroy the biological digestion taking place within your septic system.

Septic systems are a very simple way to treat household wastewater and are easy to operate and maintain. Although homeowners must take a more active role in maintaining septic systems, once they learn how their systems work, it is easy for them to appreciate the importance of a few sound operation and maintenance practices.



For more information regarding the care of your septic system, contact your local health department.

More information about septic systems is available from the National Small Flows Clearinghouse (NSFC) through other brochures in this series:

Groundwater protection and your septic system,
Item **#WWBRPE21**

So . . . now you own a septic system,
Item **#WWBRPE20**

For more information about this or other NSFC products, please contact us by writing to:
National Small Flows Clearinghouse
West Virginia University
P.O. Box 6064
Morgantown, WV 26506-6064
or phone:
(800) 624-8301, (304) 293-4191
or fax (304) 293-3161
www.nsfc.wvu.edu

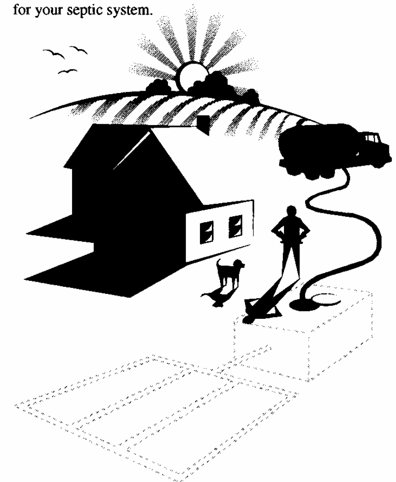
Helping America's small communities meet their wastewater needs

NATIONAL SMALL FLOWS CLEARINGHOUSE

NATIONAL SMALL FLOWS CLEARINGHOUSE

The care and feeding of your septic system

One in a series of three brochures designed to aid you in caring for your septic system.



Helping America's small communities meet their wastewater needs

The care and feeding of your septic system

Septic systems are very much like automobiles. They need periodic inspections and proper maintenance to continue working properly. Also, like automobiles, they must be operated properly and cannot be overtaxed without the owner suffering consequences such as repair or replacement bills.

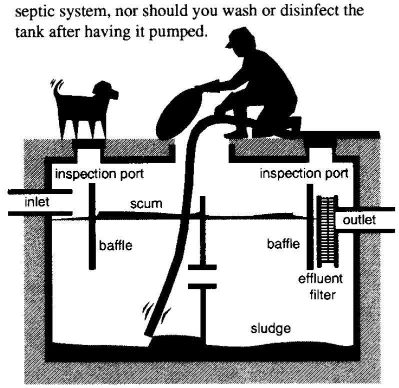
Often overlooked or neglected is the fact that a septic system should have a regular check-up to prevent problems. You should have your septic system inspected every 1-2 years by a professional and your tank pumped when necessary. The septic tank traps the solids in the wastewater and should be checked to determine whether or not it is time for it to be pumped out. The inspection port should be opened and the baffles (internal slabs or tees) should be checked to ensure that they are in good condition since the last check-up (see Figure 1). If you have a septic tank effluent filter, it should also be inspected. Effluent filters require periodic cleaning. Some filters are now equipped with alarm systems to alert the homeowner when the filter has become dirty and needs to be cleaned. Failure to keep the filter clean may result in a backup of wastewater in the home from a clogged filter. Septic systems that have mechanical parts such as a pump should be inspected at least once a year or more frequently as recommended by the manufacturer. The absorption field should be checked for sogginess or ponding, which indicates improper drainage, a clogged system, or excessive water use. The presence of damp or soggy areas or odors may indicate a leak in the system.

SEPTIC TANK

A properly designed septic system will have a septic tank with sufficient volume to accumulate solids for several years. As the level of solids rises in the tank, the wastewater has less time to settle properly and suspended solid particles flow into the absorption field. If the tank is not periodically pumped out, these solids will eventually clog the absorption field to the point where a new field will be needed.

When the tank is pumped, the contractor should pump the contents through the manhole, which is usually located in the center of the tank, rather than through the inspection ports. Pumping through one of the inspection ports could damage the baffles inside the tank (see Figure 1). Damage to the baffles could result in the wastewater flowing directly into the absorption field without the opportunity for the solids to settle.

Remember, commercial septic tank additives do not eliminate the need for periodic pumping and may be harmful to the absorption field. You should check your local health department regulations before using additives. Be sure when the septic tank is pumped that it is completely emptied. It is not necessary to retain any of the solids to restart the digestive process. You do not need biological or chemical additives for successful restart or continuous operation of your septic system, nor should you wash or disinfect the tank after having it pumped.



Cross-section of a two-compartment septic tank being pumped **Fig. 1**

When to Have Your Septic Tank Pumped

A specific determination of when it's time to pump out the solids can be made by having the depth of solids and level of scum buildup on top of the wastewater in the septic tank checked periodically. Two factors affect how often you should have your septic tank pumped. Whether you need to have your tank pumped every year, once every five years, or some other time interval is affected by these factors. The first factor is the size or capacity of the tank itself. If more people are living in the home than when the system was installed, or if new high water use appliances or technologies such as a hot tub or whirlpool bath are now in use, then the capacity may be too small. The more people using a system, the faster the solids will accumulate in the tank, and the more frequently the tank will need to be pumped. Also, the additional surge of water from hot tubs and whirlpool baths may wash solids out of the tank and into the absorption field. An inspection can determine whether the system is of adequate capacity to handle the volume of solids and flow from the number of people in the household and types of appliances used. A larger capacity system provides better treatment and requires less pumping.

The second factor is the volume of solids in the wastewater. If you have a garbage disposal, for example, you will have to pump out your system more frequently than persons disposing of their food wastes through other means. The use of a garbage disposal may increase the amount of solids in the septic tank by as much as 50 percent. Excessively soiled clothes may add solids to your septic tank. Sometimes, geographical location may also contribute to extra solids ending up in the septic tank. For example, systems in coastal areas may have an accumulation of sand in the septic tank from washing beach clothes.

Reducing the Flow of Wastewater

Generally, the more people, the more water will flow through the system. However, the use of water conservation devices such as low-flow toilets or shower fixtures greatly reduces the amount of wastewater thus prolonging the life of your septic system. For example, up to 53 gallons of water are discharged into your system with each load of laundry. If several loads are done in one day, it can put considerable stress on your system. A better practice would be to space your laundry washing throughout the week.

The new ultra low-flush toilets use between 1 and 1.6 gallons of water per flush and will provide as much as a 30 percent water savings. Low-flow faucet aerators on sink faucets and low-flow showerheads will save additional water. There are also low-flow washing machines which use much less water than standard washing machines.

ABSORPTION FIELD

An absorption field generally does not require any maintenance. However, to protect and prolong the life of the absorption field, follow these simple rules:

- Plant only grass over and near your septic system. Roots from nearby trees or shrubs may clog and damage the absorption field.
- Do not drive or park over any part of your septic system. This can compact the soil and crush your system.
- Direct all wastewater from your home into the septic tank. This includes all sink, bath, shower, toilet, washing machine and dishwasher wastewaters. Any of these wastewaters can contain disease-causing microorganisms or environmental pollutants.
- Keep roof drains, basement sump pump drains, and other rainwater or surface water drainage systems away from the absorption field. Flooding of the absorption field with excessive water will keep the soil from naturally cleansing the wastewater, which can lead to groundwater and/or nearby surface water pollution.

continued . . .

Appendix A-3: Monitoring Wastewater Characteristics

Many methods can be used to monitor an onsite wastewater treatment system's performance. They vary from something as simple as checking for sewage on the soil surface, to complicated laboratory analysis.

Costs vary from lab to lab, but estimates are given. Be sure to contact the lab prior to dropping off samples.

Certified Labs

When choosing a lab to perform analysis of wastewater characteristics, a certified lab is required, because these labs use approved standard methods and procedures. The Iowa Department of Natural Resources maintains a list of labs across Iowa that are certified. This can be found on their web site at **http://www.uhl.uiowa.edu/ClientLink/index.html** under Environmental Laboratory Certification Reports

Sampling Location

There are many locations where samples can be taken. It is best if the sample locations are determined when the system is being designed, and then built in. Effluent chambers, pump tanks and sampling ports are suggested locations for obtaining samples.

Some obvious locations where the wastewater characteristics are of interest are

- as it leaves the home
- as it leaves the tank
- at system's "end-of-pipe"
- in groundwater (lysimeter, sampling wells)
- in soil (dry gram soil/microgram fecal)

Piezometers can be used to determine the amount of separation but are not to be used to sample groundwater. Lysimeters or soil access ports can be used to determine the amount of fecal coliform bacteria under system.

Monitored Parameters

container: plastic
amount: 500 mL
max holding time: 24 hr

Biochemical Oxygen Demand (BOD) is a measurement of the dissolved oxygen used by microorganisms in the oxidation of organic matter in sewage in five days, and is the most widely used parameter applied to wastewater. Tests for BOD must be run within 24 hours of taking the sample because the value will change as microorganisms in the sample continue to metabolize organic matter and use up the dissolved oxygen. An average cost for a BOD test is $30. A minimum of 500 milliliters is required to run the test. A typical BOD value for septic tank effluent is 175-220 milligrams per liter.

Color is an indication of how “clean” the wastewater is. A black sample represents wastewater that is anaerobic and still needs significant treatment. A clear sample indicates that BOD and TSS have been minimized. A cloudy gray sample indicates that the septic tank is not operating properly. Properly operating aerobic treatment units will produce a chocolatey brown sample.

test on site

Dissolved oxygen (DO) is a measure to determine how much oxygen is in wastewater. The maximum level of DO in water is 12 milligrams per liter. Septic tanks usually have very low values of DO because the microorganisms in the septic tank use up all oxygen initially present. A typical value for DO in a septic tank is one milligram per liter. This can be measured with a probe or using a kit a that evaluates the DO by comparing the color of a sample after a chemical is added. The DO must be measured when the sample is taken or soon after because the level will decrease over time. DO testing kits cost about $30 and contain reagents for about 30 tests.

container: sterile bag such as “Whirl-Pak”
amount: 50mL
max holding time: 6 hr

Fecal coliform bacteria are an indicator organisms. Many of the pathogenic organisms present in wastewater are difficult to isolate and identify. However, the human intestinal tract contains countless coliform bacteria, which are easy to detect. The presence of fecal coliform is an indication that other pathogenic organisms are likely to be present. The number of fecal coliform bacteria will change over time; therefore a fecal coliform test must be run within six hours of taking the sample. An average cost for a fecal coliform test is $16. A 500-milliliter* sample is sufficient. An average value for septic tank effluent is 1,000,000 organisms/100 milliliters.

** The volume of sample need for the tests is determined by the testing facility. They may need more or less than this specified amount.*

container: glass
amount: 1 quart
max holding time: 28 days at pH < 2 and 4 degrees C

Fats, oils, and greases (FOG) are added to wastewater through the use of butter, lard, margarine, vegetable oil, and meat. A typical value for FOG from a septic tank is 20 milligrams per liter. A restaurant can produce very high values, often greater than 100 milligrams per liter. A quart or more of the effluent is required to run this test. An average cost of this test is $30. The cost is relatively high because of the chemicals required for this test.

container: plastic amount: 100 mL max holding time: 28 days at 4 degrees C

Nitrogen is a nutrient essential to the growth of plants and microorganisms. High levels can be toxic to humans. If it reaches surface water in the form of ammonia, it is toxic to fish. Wastewater naturally contains fairly high levels of nitrogen. A typical level of nitrogen in septic tank effluent is 40 milligrams per liter. A 100-milliliter sample should be sufficient for a nitrogen test. An average cost for a nitrogen test is $15.

container: plastic amount: 100 mL max holding time: 28 days at pH < 2 and 4 degrees C

Phosphorous is a nutrient essential to the growth of plants and microorganisms. This nutrient causes increased growth of aquatic vegetation in surface waters. A typical value for septic tank effluent is seven milligrams per liter of phosphorous. A sample of at least 100 millilters is needed. An average cost for a total phosphorous test is $15.

container: plastic amount: 100 mL max holding time: 7 days at 4 degrees C

Total Suspended Solids (TSS) is a measure of the organic and inorganic solids that remain in wastewater after separation occurs in the septic tank. One way to test for TSS is to measure turbidity, or the amount of light transmitted through the sample. This can be done in the field or at a lab. An average suspended solids value of septic tank effluent is 65 milligrams per liter. A 100-millilter sample is needed. An average cost for a TSS test, either a turbidity test or a different kind of analysis, is $15.

check temperature on site

Temperature of wastewater is a very important parameter because of its effect on chemical reactions. Temperature of wastewater varies from 45F to 70F depending on the season. Wastewater temperature is usually not a problem for individual residences, but very low or very high temperatures can be a problem for restaurants and infrequently-used homes. The temperature of the wastewater must be measured immediately upon taking the sample.

check for odor on site

Odor. A strong is often detected when a system is not performing properly.

check meter on site or remotely

Flow meters are used to measure the volume of wastewater going to an on-site system. They are usually located in the basement; flow can also be calculated from pump cycle or tipping bucket data.

Appendix A-4: Definitions

These definitions were taken from several sources and we wish the thank the following:

Gregg A. Eckhardt, eckhardt@txdirect.net

References definitions were adapted from

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2. Hoover, M.T., T.A. Disy, M.A. Pfeiffer, N. Dudley, R.B. Mayer, and B. Buffington. 1996. North Carolina subsurface wastewater system operators training school manual. Soil Science Department, College of Agriculture and Life Sciences, North Carolina State University, Raleigh, NC and North Carolina Department of Environment, Health, and Natural Resources, Raleigh, NC.

3. Kahn, L., B. Allen, and J. Jones. 2000. *The Septic System Owner's Manual.* Bolinas, CA: Shelter Publications .

4. Trotta, P., J. Ramsey, and S. Hoban. 2000. The basics and fundamentals of onsite wastewater treatment course. Flagstaff, AZ: Northern Arizona University.

5. Arizona Department of Environmental Quality. Aquifer Protection Permits. R18-9-101. January 1, 2001. Phoenix, AZ: ADEQ.

6. Burks, B.D. and M.M. Minnis. 1994. *Onsite Wastewater Treatment Systems*. Madison, WI: Hogarth House, Ltd.

Administrative Authority - is the local board of health as authorized by Iowa Code section 455B.172 and 567--Chapter 137.

abandoned well -a well which is no longer used. In many places, abandoned wells must be filled with approved sealing material to prevent pollution of ground water bodies.

absorb - to take in.

absorption-The process by which one substance is physically taken into and included with another substance. [3]

acute toxicity - Exposure that will result in significant response shortly after exposure (typically a response is observed within 48 or 96 hours). [1]

adhesion - the molecular attraction asserted between the surfaces of bodies in contact. Compare cohesion.

administrative authority - is the local board of health as authorized by Iowa Code Section 455B.172 and 567--Chapter 137.

adsorption - the adhesion of a substance to the surface of a solid or liquid. Adsorption is often used to extract pollutants by causing them to be attached to such adsorbents as activated carbon or silica gel.

advanced treatment -Removal of dissolved and suspended materials remaining after normal biological treatment when required for water reuse or for the control of eutrophication in receiving waters. [1]

aeration - the mixing or turbulent exposure of water to air and oxygen to stimulate breakdown in the waste stream, or to dissipate volatile contaminants and other pollutants into the air.

aerobic - Growing in the presence of oxygen, as in aerobic bacteria or aerobic treatment. [2]

aerobic treatment unit - A container of various configurations that provides for aerobic degradation or decomposition of wastewater constituents by bringing the wastewater into direct contact with air by some mechanical means. [4]

alluvium - sediments deposited by erosional processes, usually by streams.

alternative system - An onsite sewage system other than a conventional gravity system or a conventional pressure distribution system. Properly operated and maintained alternative systems provide equivalent or enhanced treatment performance as compared to conventional gravity systems. [4]

anaerobic - Growing in the absence of oxygen, as in anaerobic bacteria in a septic tank. [2]

anoxic process - The process by which nitrate-nitrogen is converted biologically to nitrogen gas in the absence of oxygen. The process is also known as anoxic denitrification. [1]

approved - A written statement of acceptability, in terms of the requirements in local and state regulations issued by the local health officer. [4]

approved list - A list of approved systems and products, developed by local health departments which may contain the following: list of proprietary devices approved by the department; list of specific systems meeting Treatment Standard 1 and Treatment Standard 2; list of experimental systems approved by the department; and list of septic tanks, pump chambers, and holding tanks approved by the department. [4]

aquifer - a geologic formation that will yield water to a well in sufficient quantities to make the production of water from this formation feasible for beneficial use; permeable layers of underground rock or sand that hold or transmit groundwater below the water table.

area drain - means a drain installed to collect surface or storm water from an open area of a building or property.

artesian aquifer - a geologic formation in which water is under sufficient hydrostatic pressure to be discharged to the surface without pumping.

artesian well - a water well drilled into a confined aquifer where enough hydraulic pressure exists for the water to flow to the surface without pumping.

attached-growth processes - Biological treatment processes in which the microorganisms responsible for the conversion of the organic matter or other constituents in the wastewater to gases and cell tissue are attached to some inert medium, such as rocks, slag, or specifically designed ceramic or plastic materials. Attached-growth treatment processes are also known as fixed-film processes. [1]

at-grade – this is an above ground pressure distribution system. This is similar to a mound without the sand.

baffles - Deflectors, vanes, guides, grids, gratings, or similar devices constructed or placed in flowing water, wastewater, or slurry systems as a check or to effect a more uniform distribution of velocities; absorb energy; divert, guide, or agitate the liquids; and check eddies. [3]

ball valve - A simple non-return valve consisting of a ball resting on a cylindrical seat within a fluid passageway. [3]

biochemical oxygen demand (BOD) - A standard test that measures the strength of wastewater by determining the quantity of oxygen that is naturally consumed by the wastewater under standard conditions. Generally it is measured in mg/L. [2]

biological filter - A bed of sand, gravel, broken stone, peat moss or other medium through which wastewater flows or trickles, which depends on biological action for effectiveness. [3]

biomat - The *biological mat* (biomat) is a black, jelly-like mat about one to two inches thick, that forms at the gravel-soil interface at the bottom and sidewalls of the drainfield trench. The biomat is composed of microorganisms (and their byproducts) that anchor themselves to soil and rock particles, and whose food is the organic matter in the septic tank effluent. Since the biomat has a low permeability, it increases contact time, so the microorganisms can break down the wastewater to provide effluent treatment. Also known as a clogging mat.[3]

biosolids - a nutrient-rich organic material resulting from the treatment of wastewater. Biosolids contain nitrogen and phosphorus along with other supplementary nutrients in smaller doses, such as potassium, sulfur, magnesium, calcium, copper and zinc. The application of biosolids to land improves soil properties and plant productivity, and reduces dependence on inorganic fertilizers.

blackwater - That portion of the wastewater stream that originates from toilets. It includes feces, urine, and associated flush waters. [4]

BOD - Biochemical Oxygen Demand. A measure of the amount of oxygen required to neutralize organic wastes, oxidize inorganic material and nitrogen.

building drain - is that part of the lowest horizontal piping of a house drainage system which receives the discharge from soil, waste, and other drainage pipes inside the walls of any building and conveys the same to the building sewer.

building sewer - is that part of the horizontal piping from the building wall to its connection with the main sewer or the primary treatment portion of an on-site wastewater treatment and disposal system conveying the drainage of one building site.

buoyancy - the tendency of a body to float or rise when immersed in a fluid; the power of a fluid to exert an upward force on a body placed in it.

calcium carbonate - CACO3 - a white precipitate that forms in water lines, water heaters and boilers in hard water areas; also known as scale.

capillary zone - soil area above the water table where water can rise up slightly through the cohesive force of capillary action. See phreatophytes.

carbonates - the collective term for the natural inorganic chemical compounds related to carbon dioxide that exist in natural waterways.

cesspool - A lined or partially lined underground pit into which raw household wastewater is discharged and from which the liquid seeps into the surrounding soil. Sometimes called *leaching cesspool*. [3]

CFU - colony forming units.

chamber system - is a buried structure, typically with a domed or arched top, providing at least a six-inch height of sidewall soil exposure, creating a covered open space above a buried soil infiltrative surface.

chemical oxygen demand (COD) - A standard test that measures the amount of the organic matter in wastewater that can be oxidized (burned up) by a very strong chemical oxidant. [2]

chlorination - the adding of chlorine to water or sewage for the purpose of disinfection or other biological or chemical results.

chlorine demand - the difference between the amount of chlorine added to water, sewage, or industrial wastes and the amount of residual chlorine remaining at the end of a specific contact period. Compare residual chlorine.

chronic toxicity - Exposure that will result in sublethal response over a long term, often one-tenth of the life span or more. [1]

cistern - a tank used to collect rainwater runoff from the roof of a house or building.

clarification - Any process or combination of processes, the primary purpose of which is to reduce the concentration of suspended matter in a liquid. Term formerly used as a synonym of *settling* or *sedimentation*. In recent years, the latter terms are preferable when describing the settling process. [3]

cleanout - Any structure or device which is designed to provide access for the purpose of removing deposited or accumulated materials. [3]

clogging mat - See biomat.

cohesion - a molecular attraction by which the particles of a body are united throughout the mass whether like or unlike. Compare adhesion.

coliform – A family of bacteria. The presence of coliform bacteria is an indication of possible pathogenic bacterial contamination. *Fecal coliforms* are those coliforms found in the feces of various warm-blooded animals, whereas the term *coliform* also includes other non-pathogenic species. [2]

coliform bacteria – A family of non-pathogenic and pathogenic microorganisms.

combined sewer - a sewer system that carries both sanitary sewage and stormwater runoff. When sewers are constructed this way, wastewater treatment plants have to be sized to deal with stormwater flows and oftentimes some of the water receives little or no treatment. Compare separate sewer.

composite sample, weighted - a sample composed of two or more portions collected at specific times and added together in volumes related to the flow at time of collection. Compare grab sample.

concentration - amount of a chemical or pollutant in a particular volume or weight of air, water, soil, or other medium.

conduit - a natural or artificial channel through which fluids may be conveyed.

cone of depression - natural depression in the water table around a pumping well.

confined aquifer - an aquifer that lies between two relatively impermeable sedimentary layers.

confluent growth - in coliform testing, abundant or overflowing bacterial growth which makes accurate measurement difficult or impossible.

consolidated formation - naturally occurring geologic formations that have been lithified (turned to stone). The term is sometimes used interchangeably with the term "bedrock." Commonly, these formations will stand at the edges of a bore hole without caving.

constituents - Individual components, elements, or biological entities such as suspended solids or ammonia nitrogen. [1]

contaminants - Constituents added to the water supply through use. [1]

conventional gravity system - An onsite sewage system consisting of a septic tank and a subsurface soil absorption system with gravity distribution of the effluent [4]

creeping (progressive) failure - A condition in aging wastewater systems where the biomat becomes so intensely developed that no water can flow through it eventually causing system malfunction. Another definition is: The formation of the biomat in a gravity distribution system where the biomat becomes overdeveloped at the beginning of the trenches (through hydraulic overloading), which forces the wastewater to travel further and farther down the trenches to be dispersed. Once the biomat has overdeveloped along the entire distance, system malfunction occurs. [2]]

cubic feet per second (CFS) - the rate of discharge representing a volume of one cubic foot passing a given point during 1 second. This rate is equivalent to approximately 7.48 gallons per second, or 1.98 acre-feet per day.

current - the portion of a stream or body of water which is moving with a velocity much greater than the average of the rest of the water. The progress of the water is principally concentrated in the current. See thalweg.

denitrification - The anaerobic biological reduction of nitrate-nitrogen to nitrogen gas. Also removal of total nitrogen from a system. [3]

deposit - something dropped or left behind by moving water, as sand or mud.

design life - The estimated length of time before the system will have to be replaced or rehabilitated. [6]

detection limit - the lowest level that can be determined by a specific analytical procedure or test method.

detention time - The period of time that a water or wastewater flow is retained in a basin, tank, or reservoir for storage or completion of physical, chemical, or biological reaction. [3]

discharge - the volume of water that passes a given point within a given period of time. It is an all-inclusive outflow term, describing a variety of flows such as from a pipe to a stream, or from a stream to a lake or ocean.

discharge permit - a permit issued by the Iowa Department of Natural Resources that allows the discharge of treated effluent into waters of the State or the United States.

disinfection – the process of destroying pathogenic organisms in water and wastewater. Usually accomplished by introduction of chlorine, but more and more facilities are using exposure to ultraviolet radiation, which renders the bacteria sterile.

disinfection byproducts - halogenated organic chemicals formed when water is disinfected.

dispersion - the movement and spreading of contaminants out and down in an aquifer.

displacement - distance by which portions of the same geological layer are offset from each other by a fault.

dissolved oxygen - The concentration of oxygen (normally a gas) dissolved in water. It is a function of temperature and pressure. The colder the water, the more oxygen it will hold. In general, fish require 5.0 mg/L in a stream. [2]

distribution box - is a structure designed to accomplish the equal distribution of wastewater to two or more soil absorption trenches.

domestic wastewater - Wastewater that is generated from sanitary fixtures and appliances, food handling, etc. [2]

drain pipes - A pipe or conduit that carries untreated runoff water to nearby waterways to reduce flooding of pavements. Not to be confused with sewers which carry wastewater. [2]

drainage ditch - is any watercourse meeting the classification of a "general use segment" under rule 567--61.3(455B) which includes intermittent watercourses and those watercourses which typically flow only for short periods of time following precipitation in the immediate locality and whose channels are normally above the water table.

drip irrigation - is a form of subsurface soil absorption using shallow pressure distribution with low pressure drip emitters.

drop box - is a structure to divert wastewater flow into a soil absorption trench until the trench is filled to a set level, then allow any additional waste, which is not absorbed by that trench, to flow to the next drop box or soil absorption trench.

drywell - A well which is a bored, drilled, or driven shaft or hole whose depth is greater than its width and is designed and constructed specifically for the disposal of storm water. [5]

dwelling means any house or place used or intended to be used by humans as a place of residence.

effluent - Wastewater, partially or completely treated, flowing out of a reservoir, tank, treatment component, or disposal component. [4]

enteric viruses - a category of viruses related to human excreta.

EPA - Environmental Protection Agency

eutrophication - The process by which a waterbody becomes over-enriched with nutrients. While this is a naturally-occurring process, it can be accelerated by human activities and generally results in a less-diversified and less-desirable waterbody. [2]

facultative processes - Biological treatment processes in which the organisms can function in the presence or absence of molecular oxygen. [1]

failure - Inability of water to penetrate the soil. [6]

fecal coliform - Indicator bacteria common to the digestive systems of warm-blooded animal that is cultured in standard tests to indicate contamination from sewage or level of disinfection. Generally measured as colonies/100 mL. [2]

fill soil - means clean soil, free of debris or large organic material, which has been mechanically moved onto a site and has been in place for less than one year.

fixed-film processes - See attached-growth processes.

flocculate - To cause particles to form small lumps or masses. [3]

flow rate (or discharge or "Q") - Minimum design pumping rate required to deliver effluent to a wastewater system uniformly. [2]

foundation drain - the portion of a building drainage system provided to drain groundwater from the outside of the foundation or over or under the basement floor. It is not connected to the building drain.

free access filter (open filter) - means an intermittent sand filter constructed within the natural soil or above the ground surface with access to the distributor pipes and top of the filter media for maintenance and media replacement.

french drain - An underground passageway for water through the interstices among stones placed loosely in a trench. [3]

grab sample - a sample taken at a given place and time. Compare composite sample.

gravel - means stone screened from river sand or quarried. Concrete aggregate designated as Class II by the department of transportation is acceptable for use in wastewater systems.

gravelless pipe system - means an absorption system comprised of large diameter (8 and 10 inches) corrugated plastic pipe, perforated with holes on a 120-degree arc centered on the bottom, wrapped in a sheath of geotextile filter wrap and installed level in a trench without gravel bedding or cover.

grease interceptor (trap) - In plumbing, a receptacle designed to collect and retain grease and fatty substances normally found in kitchen or similar wastes. It is installed in the drainage system between the kitchen or other point of production of the waste and the building sewer. [3]

greywater - That portion of the wastewater stream that originates in sinks, tubs, showers, laundry; i.e., all portions of the wastewater stream excluding toilet wastes. [4]

groundwater - water within the earth that supplies wells and springs; water in the zone of saturation where all openings in rocks and soil are filled, the upper surface of which forms the water table.

hardpan - a shallow layer of earth material which has become relatively hard and impermeable.

hydraulic Failure- The user is putting more water into the treatment unit than the unit was designed to treat.

hydraulic loading rate – the rate at which the soil will accept water or wastewater.

impermeable - material that does not permit fluids to pass through.

impervious - the quality or state of being impermeable; resisting penetration by water or plant roots. Impervious ground cover like concrete and asphalt affects quantity and quality of runoff.

indicator organisms - microorganisms, such as coliforms, that indicate the presence of pollution or potentially harmful microorganisms.

indicator tests - tests for a specific contaminant, group of contaminants, or constituent which signals the presence of something else (ex., coliforms indicate the possible presence of pathogenic organisms).

individual mechanical aerobic wastewater treatment system - means an individual wastewater treatment and disposal system employing bacterial action which is maintained by the utilization of air or oxygen and includes the aeration plant and equipment and the method of final effluent disposal.

industrial wastewater - Wastewater from industrial processes or contaminated with wastewater from industrial processes. This does not fall under Chapter 69 and requires a permit from the State. [2]

infiltration - The flow or movement of water through the interstices of pores of soil or other porous medium.[3] (2) Groundwater seeping into a collection system. [2]

inflow - Direct rainflow, such as rooftop drains, into a collection system. [2]

influent - Wastewater, partially or completely treated, or in its natural state (raw wastewater) that flows into a reservoir, tank, treatment component, or disposal component. [4]

inorganic - The minerals, salts, etc. present in wastewater not attributed to carbon molecules. Examples include iron, silver, lead, sodium. [2]

intermittent sand filters - are beds of granular materials 24 to 36 inches deep underlain by graded gravel and collecting tile. Wastewater is applied intermittently to the surface of the bed through distribution pipes or troughs and the bed is underdrained to collect and discharge the final effluent. Uniform distribution is normally obtained by dosing so as to flood the entire surface of the bed. Filters may be designed to provide free access (open filters), or may be buried in the ground (buried filters or subsurface sand filters).

lagoon - a shallow pond where sunlight, bacterial action, and oxygen work to purify wastewater. Lagoons are typically used for the storage of wastewaters, sludges, or liquid wastes.

lake - means a natural or man-made impoundment of water with more than one acre of water surface area at the high water level.

leachate - water containing contaminants which leaks from a disposal site such as a landfill or dump.

limiting layer - means bedrock, seasonally high groundwater level, or any layer of soil with a stabilized percolation rate exceeding 60 minutes for the water to fall one inch, or a soil loading rate less than 0.3 gpsf.

low pressure pipe (LPP) - Lateral 1" - 2" pipe with small orifices (5/32" - 1/4") through which effluent is distributed to trench under low pressure (2 to 5 feet of head). [2]

mastic - Any of various pasty materials used as protective coatings or cements. [3]

MCL - Maximum Contaminant Level - the maximum level of a contaminant allowed in water by federal law. Based on health effects and currently available treatment methods.

mermaid- a fabled marine creature usually represented as having the head, trunk, and arms of a woman and the lower part like a tail of a fish.

micrograms per liter - Ug/L - micrograms per liter of water. Is usually used when concentration is less than 0.1 mg/L. One thousands micrograms per liter is equivalent to 1 milligram per liter. This measure is equivalent to parts per billion (ppb)

milligrams per liter - mg/L - milligrams per liter of water. This measure is equivalent to parts per million (ppm).

mound system - is an above-ground system used to treat effluents from septic tanks in cases where a limiting layer or limited land area prohibits the use of conventional subsurface absorption systems. A mound is a hybrid sand filter placed on top of the soil and after the wastewater is treated in the sand filter the water is dispersed into the soil.

municipal sewage - sewage from a community which may be composed of domestic sewage, industrial wastes or both.

nitrification - The oxidation of ammonia-nitrogen to nitrate-nitrogen in wastewater by biological or chemical reactions. [3]

nitrogen - a plant nutrient that can cause an overabundance of bacterial and algael growth, leading to a depletion of oxygen and fish kills. Several forms occur in water, including ammonia, nitrate, nitrite or elemental nitrogen. High levels of nitrogen in water are usually caused by agricultural runoff or improperly operating wastewater treatment plants. Also see phosphorous.

nonconsumptive use - using water in a way that does not reduce the supply. Examples include hunting, fishing, boating, water-skiing, swimming, and some power production. Compare consumptive use.

nonpoint source - source of pollution in which wastes are not released at one specific, identifiable point but from a number of points that are spread out and difficult to identify and control. Onsite wastewater systems are considered to be nonpoint sources of pollution. Compare point source.

nonpotable - not suitable for drinking. Compare potable.

NPDES permit - permit issued under the National Pollutant Discharge Elimination System for open discharge systems, issued by the Iowa Department of Natural resources.

nutrients - The minerals and other materials that provide food for living organisms. Traditionally, nitrogen, phosphorous, and potassium are thought of as the most important elemental nutrients for streams and lakes. [2] As a pollant, any element or compound, such as phosphorous or nitrogen, that fuels abnormally high organic aquatic ecosystems. Also see eutrophic.

on-site wastewater treatment and disposal system - means all equipment and devices necessary for proper conduction, collection, storage, treatment, and disposal of wastewater from four or fewer dwelling units or other facility serving the equivalent of 15 persons (1,500 gpd) or less. This includes domestic waste whether residential or nonresidential but does not include industrial waste of any flow rate. Included within the scope of this definition are building sewers, septic tanks, subsurface absorption systems, above-ground (mound & at-grade) systems, sand filters, constructed wetlands and individual mechanical/aerobic wastewater treatment systems.

onsite wastewater treatment facility (sewage system) - An integrated arrangement of components for a residence, building, industrial establishment, or other places not connected to a public sewer system which: conveys, stores, treats, and/or provides subsurface soil treatment and disposal on the property where it originates or upon adjacent or nearby property; and includes piping, treatment devices, other accessories, and soil underlying the disposal component of the initial and reserve areas. [4]

organic - The molecules, cells, etc. in wastewater from living organisms based on elemental carbon. [2]

organic chemicals - chemicals containing carbon.

orifice - Discharge hole in low pressure lateral or pressure manifold. [2]

outfall - the place where a wastewater treatment plant discharges treated water into the environment.

outwash - a deposit of sand and gravel formed by streams of meltwater flowing from a glacier.

parameter - A measurable factor such as temperature. [1]

pathogens - Organisms that cause disease. Examples in wastewater include Salmonella, Vibro Cholera, and Entamoeba histolytica. [2]

perched water table - groundwater standing unprotected over a confined zone.

percolation - the movement of water through the soil profile, usually continuing downward to the groundwater.

percolation test - is a falling water level procedure used to determine the ability of soils to absorb primary treated wastewater. (See Section B- Appendix B.)

permeability - the ability of a material to transmit water. It is measured by the quantity of water passing through a unit cross section, in a unit time, under 100 percent hydraulic gradient.

permeable - Having pores or openings that permit liquids or gases to pass through. [3]

pH - numeric value that describes the intensity of the acid or basic (alkaline) conditions of a solution. The pH scale is from 0 to 14, with the neutral point at 7.0. Values lower than 7 indicate the presence of acids and greater than 7.0 the presence of alkalis (bases). Technically speaking, pH is the logarithm of the reciprocal (negative log) of the hydrogen ion concentration (hydrogen ion activity) in moles per liter.

phosphorous - a plant nutrient that can cause an overabundance of bacteria and algae growth, leading to a depletion of oxygen and fish kills. High levels of phosphorous in water are usually caused by agricultural runoff or improperly operating wastewater treatment plants. Also see nitrogen.

physical weathering - breaking down of parent rock into bits and pieces by exposure to temperature and changes and the physical action of moving ice and water, growing roots, and human activities such as farming and construction. Compare chemical weathering.

phytoplankton - free-floating, mostly microscopic aquatic plants.

piezometric surface - the imaginary surface to which groundwater rises under hydrostatic pressure in wells or springs.

plankton - microscopic floating plant and animal organisms of lakes, rivers, and oceans.

plug - cement, grout, or other material used to fill and seal a hole drilled for a water well.

plume - the area taken up by contaminant(s) in an aquifer.

point source - source of pollution that involves discharge of wastes from an identifiable point, such as a smokestack or sewage treatment plant. Compare nonpoint source.

pollution - undesirable change in the physical, chemical, or biological characteristics of the air, water, or land that can harmfully affect the health, survival, or activities of humans or other living organisms.

pond - an impoundment of water with a water surface area of one acre or less at the high water level.

porous - something which allows water to pass through it. Compare nonporous.

potable - suitable, safe, or prepared for drinking. Compare non-potable.

ppb - parts per billion - number of parts of a chemical found in one billion parts of a solid, liquid, or gaseous mixture. Equivalent to micrograms per liter (Ug/L).

ppm - parts per million - number of parts of a chemical found in one million parts of a solid, liquid, or gaseous mixture. Equivalent to milligrams per liter (mg/L).

preservative - a chemical added to a water sample to keep it stable and prevent compounds in it from changing to other forms or to prevent microorganism densities from changing prior to analysis. Controlling the temperature can also be a form of perservation.

pressure distribution - the equal distribution of effluent throughout a trench or bed by pumping of effluent through a system of pipes.

primary treatment - treatment in which solids and greases/oils are separated out and suspended solids in the sewage settle out as sludge. This is typically the septic tank. Compare secondary treatment, tertiary treatment.

professional soil analysis - a knowledgeable person evaluating the soil factors, such as color, texture, limiting layers and structure, in order to determine a wastewater loading rate for the soil and appropriate system design. Demonstrated training and experience in soil morphology (testing absorption qualities of soil by the physical examination of the soil's color, mottling, texture, structure, topography and hillslope position) shall be required to perform a professional soil analysis.

pump - a device which moves, compresses, or alters the pressure of a fluid, such as water or air, being conveyed through a natural or artificial channel.

pump chamber - A storage tank or compartment following the septic tank into which a pump and floats are installed. Effluent is pumped from the pump chamber to the disposal component of the wastewater system. In certain types of pressure distribution systems, this may also be called a "surge tank." If a siphon is used in lieu of a pump, this will be called a "siphon chamber.". [4]]

rain - water drops which fall to the earth from the air.

RCRA - Resource Conservation and Recovery Act - federal legislation requiring that hazardous waste be tracked from "cradle" (generation) to "grave" (disposal).

receiving waters - a river, ocean, stream, or other watercourse into which wastewater or treated effluent is discharged.

recharge - refers to water entering an underground aquifer through faults, fractures, or direct absorption.

reclaimed water - domestic wastewater that is under the direct control of a treatment plant owner/operator which has been treated to a quality suitable for a beneficial use.

reserve area - An area of land approved for the installation of a conforming wastewater system and dedicated for replacement of the onsite sewage system upon its failure. [4]

residual chlorine - the available chlorine which remains in solution after the demand has been satisfied. Compare chlorine demand.

restrictive layer - A stratum impeding the vertical movement of water, air, and growth of plant roots, such as hardpan, clay pan, fragipan, caliche, some compacted soils, bedrock, and unstructured clay soils. [4] [4]

reverse osmosis - a water treatment method whereby water is forced through a semipermeable membrane which filters out impurities.

roof drain - is a drain installed to receive water collecting on the surface of a roof and discharging into an area or storm drain system.

sanitary landfill - landfill that is lined with plastic or concrete or located in clay-rich soils to prevent hazardous substances from leaking into the environment.

saturation - the condition of a liquid when it has taken into solution the maximum possible quantity of a given substance at a given temperature and pressure.

scum (cake) - A layer of wastewater particles (comprised of grease/fats/oils) floating on the liquid surface in a septic tank. [3]

seal - the impermeable material, such as cement grout or bentonite placed in the annular space between the borehole wall and the casing of a water well to prevent the downhole movement of surface water or the vertical mixing of distinct aquifers.

secondary treatment system - is a system which provides biological treatment of the effluent from septic tanks or other primary treatment units to meet minimum effluent standards as required in these rules and NPDES General Permit No. 4. Examples include soil absorption systems, sand filters, above ground systems, mechanical/aerobic systems, or other systems providing equivalent treatment.

sediment - soil particles, sand, and minerals washed from the land into aquatic systems as a result of natural and human activities.

seep - a spot where water contained in the ground oozes slowly to the surface and often forms a pool; a small spring.

septage - The semi-liquid material that is pumped out of septic (or interceptor) tanks, consisting of liquid, scum, and sludge. [2]

septic tank - A water-tight primary treatment device that receives the discharge of sewage from a building sewer or sewers, designed and constructed to permit separation of settleable and floating solids from the liquid and detention and anaerobic digestion of the organic matter prior to discharge of the liquid. [4]

setback – in Iowa, setback refers to a terminology that means a minimum horizontal distance between compoents of a wastewater system and potential point of impact. [5]

settable solids - in sewage, solids that will settle when the sewage is brought to a quiet state for a reasonable length of time, usually two hours.

settleable solids - Suspended solids, in mL/L, that will settle out of suspension within a specified period of time. [1]

sewage – Untreated or partially treated wastes from toilets, baths, sinks, lavatories, laundries, and other plumbing fixtures in places of human habitation, employment, or recreation. [5]

Sewage wastewater - is the water-carried waste derived from ordinary living processes.

sewer - A pipe or conduit that carries wastewater. Not to be confused with drain pipes or other conveyances that carry water.

siltation - the deposition of finely divided soil and rock particles upon the bottom of stream and river beds and reservoirs.

sludge - solid matter that settles to the bottom of septic tanks and must be disposed of by digestion or other methods.

soil absorption capacity - In subsurface effluent disposal, the ability of the soil to absorb water. [3]

soil erosion - the processes by which soil is removed from one place by forces such as wind, water, waves, glaciers, and construction activity and eventually deposited at some new place.

spray irrigation - application of finely divided water droplets to using artificial means.

spring - an issue of water from the earth; a natural fountain; a source of a body or reservoir of water.

stream - means any watercourse listed as being a “designated use segment” which includes any watercourse which maintains flow throughout the year, or contains sufficient pooled areas during intermittent flow periods to maintain a viable aquatic community of significance.

stream segment - refers to the surface waters of an approved planning area exhibiting common biological, chemical, hydrological, natural, and physical characteristics and processes. Segments will normally exhibit common reactions to external stress such as discharge or pollutants.

sublimation - subsidence sinking down of part of the earth's crust due to underground excavation, such as groundwater removal.

subsurface soil absorption system - A system of trenches of three feet or less in width, or beds between three and ten feet in width, containing distribution pipe within a layer of clean gravel designed and installed in original, undisturbed soil for the purpose of receiving effluent, treating it, and transmitting it into the soil. Also known as leach fields, drainfields, and absorption fields.

surface irrigation - application of water by means other than spraying such that contact between the edible portion of any food crop and the irrigation water is prevented.

surface water - water that flows in streams and rivers and in natural lakes, in wetlands, and in reservoirs constructed by humans.

suspended-growth processes - Biological treatment processes in which the microorganisms responsible for the conversion of the organic matter or other constituents in the wastewater to gases and cell tissue are maintained in suspension within the liquid. [1]

TDS - total dissolved solids - the sum or all inorganic and organic particulate material. TDS is an indicator test used for wastewater analysis and is also a measure of the mineral content of bottled water and groundwater. There is a relationship between TDS and conductivity. See specific conductance.

technology-based treatment requirements - NPDES permit requirements based on the application of pollution treatment or control technologies including BTP (best practicable technology), BCT (best conventional technology), BAT (best available technology economically achievable), and NSPS (new source performance standards).

tertiary treatment - Removal of residual suspended solids, usually by granular medium filtration after primary treatment and secondary treatment. Disinfection is also typically a part of tertiary treatment. Nutrient removal is often included in this definition. [1]

total solids - The minerals, cells, etc. left in wastewater after evaporation of the water fraction at 103°C. Usually measured in mg/L. [2]

total suspended solids (TSS) - A measurement of the solids that either float on the surface of, or are in suspension in, water or wastewater. A measure of wastewater strength often used in conjunction with biochemical oxygen demand (BOD). [4]

toxicity - The adverse effect which a biologically active substance has, at some concentration, on a living entity. [3]

trace element - Any element in water or wastewater that, for reasons associated with natural distribution, industrial uses, solubility, or other factors, is present at very low concentrations. [3]

trap - (1) A device used to prevent a material flowing or carried through a conduit from reversing its direction of flow or movement or from passing a given point. (2) A device to prevent the escape of air from sewers through a plumbing fixture or catch basin. [3]

tributary - a stream that contributes its water to another stream or body of water.

turbid - thick or opaque with matter in suspension. Rivers and lakes may become turbid after a rainfall.

typical sewage - Arizona regulatory terminology that means sewage in which the total suspended solids (TSS) content does not exceed 430 mg/L, the five-day biochemical oxygen demand (BOD) does not exceed 380 mg/L, and the content of fats, oils, and greases (FOG) does not exceed 75 mg/L. [5]

unconsolidated formations - naturally occurring earth formations that have not been lithified. Alluvium, soil, gravel, clay, and overburden are some of the terms used to describe this type of formation.

USGS - United States Geological Survey

vertical separation - The depth of unsaturated, original, undisturbed soil of between the bottom of a disposal component and the highest seasonal water table, or other restrictive layer.

void - the pore space or other openings in rock or soil. The openings can be very small to cave size and are filled with water below the water table.

wastewater - water containing waste including greywater, blackwater or water contaminated by waste contact.

wastewater management district - means an entity organized in accordance with permitting legislation to perform various specific functions such as planning, financing, construction, supervision, repair, maintenance, operation and management of on-site wastewater treatment and disposal systems within a designated area.

wastewater reclamation - Processing of wastewater for reuse. [3]

water quality standards - laws or regulations, promulgated under Section 303 of the Clean Water Act, that consist of the designated use or uses of a waterbody or a segment of a waterbody and the water quality criteria that are necessary to protect the use or uses of that particular waterbody. Water quality standards also contain an antidegradation statement. Every State is required to develop water quality criteria standards applicable to the various waterbodies within the State and revise them every 3 years.

water table - level below the earth's surface at which the ground becomes saturated with water. The surface of an unconfined aquifer which fluctuates due to seasonal precipitation.

water table aquifer - an aquifer confined only by atmospheric pressure (water levels will not rise in the well above the confining bed).

Waters of the United States -

Federal regulatory terminology that means:

1. All waters that are currently used, were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters that are subject to the ebb and flow of the tide;

2. All interstate waters, including interstate wetlands;

3. All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds the use, degradation, or destruction of which would affect or could affect interstate or foreign commerce including any waters:

a. That are or could be used by interstate or foreign travelers for recreational or other purposes;

b. From which fish or shellfish are or could be taken and sold in interstate or foreign commerce; or

c. That are used or could be used for industrial purposes by industries in interstate commerce;

4. All impoundments of waters defined as waters of the United States under this definition;

5. Tributaries of waters identified in subsections (1) through (4);

6. The territorial sea; and

7. Wetlands adjacent to waters (other than waters that are themselves wetlands) identified in subsections (1) through (6). [5]

water well - any artificial excavation constructed for the purpose of exploring for or producing ground water.

watershed - land area from which water drains toward a common watercourse in a natural basin.

weather - day to day variation in atmospheric conditions. Compare climate.

wetland - area that is regularly wet or flooded and has a water table that stands at or above the land surface for at least part of the year, such as a bog, pond, fen, estuary, or marsh.

zero discharge -(1) Complete recycling of water. (2) Discharge of essentially pure water. (3) Discharge of a treated effluent containing no substance at a concentration higher than that found normally in the local environment. [3]

zone of aeration - a region in the Earth above the water table. Water in the zone of aeration is under atmospheric pressure and will not flow into a well.

zone of saturation - the space below the water table in which all the interstices (pore spaces) are filled with water. Water in the zone of saturation is called groundwater.